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Economics Information

Survey of Pesticide Use in Ontario, 2008

Ministry of Agriculture,
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Ontario

ECONOMICS INFORMATION

SURVEY OF PESTICIDE USE IN ONTARIO, 2008
Estimates of Pesticides Used on Field Crops, Fruit and Vegetable Crops, and Other Agricultural Crops

by

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Introduction

Organic pesticides have been used in Ontario since the end of the Second World War. The concern expressed by many groups regarding the contamination of fish and wildlife resulted in the need to identify and quantify the pesticides used in the Great Lakes Watershed.

Canada and the United States signed the *Great Lakes Water Quality Agreement* in 1972. The International Joint Commission (IJC), acting for the two governments, oversees all activities in pursuance of this Agreement. As part of the Water Quality Agreement, the IJC established the Pollution from Land Use Activities Reference Group (PLUARG) to determine sources, quantify inputs, and assess the impact of inputs from a variety of land use activities on water quality. These activities include those involved with agriculture as well as forestry, city and urban areas, highways, and other industries. Documentation of the volume of each pesticide used in Ontario at sub-provincial levels was essential to these studies.

The PLUARG group requested in 1972 that a survey of pesticide use be carried out every five years in the province to identify and quantify the pesticides used in the Great Lakes Watershed. The data collected would be useful in estimating pesticide use in pursuance of the IJC Agreement; detecting trends in pesticide use by crop and by region in Ontario; and gauging the local and overall effectiveness of this Ministry's work in pest and weed control.

Since 1973, surveys of **agricultural** pesticide use have been carried out every five years by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). The statistical aspects of these surveys have been handled primarily by the Statistics Unit of OMAFRA's Economic Development Policy Branch. The results appeared in *Survey of Pesticide Use in Ontario, 1973 [1], 1978 [2], 1983 [3], 1988 [4], 1993 [5], 1998 [6] and 2003 [7].* While these reports dealt from time to time with non-agricultural use such as roadside spraying and commercial applicators, there has been a consistent focus on pesticide use in agricultural crops.

As was the case in 1998 and 2003, the 2008 Survey of Pesticide Use included field crops, fruit and vegetable crops, as well as selected other agricultural crops (nursery, sod and ginseng). Data on other types of applications have not been included on this survey occasion.

Survey of Pesticide Use on Agricultural Crops

Sample Selection and Editing

In Ontario, growers must comply with training requirements relating to pesticide use in order to purchase and apply pesticides to their crops. The list of certified producers is maintained at the University of Guelph Ridgetown Campus (Ridgetown College).

This list was used as the sampling frame for the 2008 version of the Pesticide Use Survey. The sample of farms to be randomly selected from the list was designed to ensure sufficient coverage on a crop by crop basis, as well as to be representative geographically.

The selected farmers received Pesticide Use Record Forms in the spring of 2008. They were requested to maintain these forms during the crop growing season by noting spraying details such as crops treated, chemical products and concentrations used, application rates, area grown and area sprayed. Respondents were asked to return the forms to Ridgetown College in the fall for manual editing and data entry.

About 1,300 forms were returned with useful information. No names, addresses, telephone numbers or other personal identifiers accompanied these forms - in fact, the only geographic identifier was the county. Each questionnaire was checked for consistency and completeness, and, as much as possible, appropriate adjustments were made for missing data.

Data processing, statistical analysis and tabulation of results were responsibilities of the Statistics Unit, Economic Development Policy Branch, Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA). Quantities of active ingredients for each chemical were computed by multiplying area sprayed times concentration times application rate. To help ensure the plausibility of the results of these calculations, pesticide specialists with OMAFRA's Agriculture Development Branch scrutinized the estimates of active ingredient usage and reviewed application rates at various stages during the preparation of this report.

Expanding the Sample Data

In order to estimate total pesticide usage on all farms, it is necessary to raise the sample results by calculating appropriate expansion factors. The expansion factor for each crop is unique. These factors are calculated as the ratio of the total provincial area of a particular crop to the area of that same crop reported in the questionnaires returned. Please refer to Appendix I for a detailed example of this calculation.

Pesticide quantities used at the county level were derived by employing proportional area breakdowns once the estimation of the active ingredients of each specific pesticide by crop at the provincial level was complete. This method of allocation was used in order to avoid distortions due to low sample sizes in some counties. More stable results are obtained by first calculating a reliable provincial level estimate of pesticide use and then allocating to counties on the basis of area grown.

The assumption here is that crops are chemically treated in a somewhat similar fashion regardless of their location in the province.

The sample occasionally had limitations in that certain specific pesticides or crops were not adequately represented and hence, pesticide use in such instances could not be estimated. The use of a given pesticide may appear to be zero when, in reality, it is likely to have been applied. There are two main reasons for this result:

(a) the use of such pesticides was not detected in the sample; or

(b) the area grown to a particular crop, while existent, was still too small to be estimable in a county - hence, no expansion factor could be computed.

In addition, it should be noted that some chemicals which are no longer licensed may still be reported as stocks in storage diminish.

Additional Notes

As with all recent versions of this survey, the scope of the 2008 Survey of Pesticide Use provides a measure of the agricultural use of pesticides on field crops as well as on field grown fruit and vegetable crops. The 1998, 2003 and 2008 surveys also include estimates of pesticide use on nursery crops, sod and ginseng (Appendix V).

Greenhouse spraying is not included. Surfactants (oils), seed treatments and other types of agricultural pesticide use such as livestock sprays and rodenticides are also excluded.

Summary of Results

Presentation

The results of the survey are presented in tabular form in Appendices II through X. Specific pesticides have been listed by their common names in the tables to avoid bias towards trade names. Appendix VII lists the common names reported in the survey.

Appendix II shows the total amount of active ingredient (a.i.) of each specific pesticide used for each field crop in the Province. Breakdowns for each specific pesticide used on total fruit, total vegetables and other agricultural crops appear in Appendices III, IV and V, respectively.

Total pesticide use on all surveyed crops is summarized in Appendix VI (by crop or crop grouping), Appendix VII (by specific pesticide), and Appendix VIII (by region or county).

Appendices IX and X compare some 2008 pesticide use information highlighted for selected crops and selected pesticides with the results from previous surveys held in 1983, 1988, 1993, 1998 and 2003.

Finally, in cases where amounts of product used were low (i.e. under 200 kg a.i.), the estimates of pesticide use have been aggregated. Although reported as "other", these pesticides were still included in the total amounts used. Totals shown throughout the tables may not appear to add due to rounding.

Highlights

The 2008 survey shows that agricultural pesticide usage has increased by approximately 15 percent since 2003 as measured by the total active ingredient (a.i.). Previous to this survey, agricultural pesticide usage was on a continual decline. Even though there was an increase in usage from 2003 to 2008, there has been an overall reduction in pesticide usage of 45 percent over the last 25 years.

Every growing season has its unique challenges. In 2008, weather conditions were one of the contributing factors resulting in the increased use of fungicides. Many areas of Ontario experienced above normal precipitation during the 2008 growing season. The re-application of fungicides was required in some crops to manage the increased disease pressure.

There was an increase in acreage of certain crops such as wheat, soybeans, white beans, canola and hay compared to 2003, which partially accounts for the increased pesticide usage in these crops. Conversely, tobacco acreage was less compared to the 2003 growing season, which is reflected in the decreased use of nematocides in this crop.

There was an increase in glyphosate use in several crops. Total usage of glyphosate has increased by approximately 76 percent from 1,170,762 kg a.i. in 2003 to 2,062,648 kg a.i. in 2008. The increased adoption of glyphosate-tolerant crops can account for a portion of this increase.

In field corn, the use of atrazine declined by approximately 10 percent compared to 2003. However, atrazine is still an important weed management tool in field corn production as indicated by the amount that was applied to this crop (448,071 kg a.i.).

Possible explanations for other trends or changes in this survey's pesticide usage are as follows:

- The outbreak of true armyworm led to an increase in insecticides used on wheat.
- The drop in tefluthrin used in field corn is due to the increased uptake of insecticide seed treatments.
- Similarly, there is a decline in the use of dimethoate in dry beans, largely due to the new availability of a seed treatment (thiamethoxam). The seed treatment tends to reduce the need, or at least the number, of foliar applications per season for potato leafhopper control.
- Pesticides that were not previously recorded for use on certain crops may be due to new or emergency use registrations. Some examples of these new registrations are as follows:
    - Propiconazole in sugarbeets (2008 emergency use registration)
    - Azoxystrobin, captan and imidacloprid in ginseng
    - Pendimethalin and s-metolachlor in some vegetable crops
    - Oxyfluorfen in onions
    - Dimethenamid in onions and grapes
    - Glufosinate ammonium in some fruit crops
    - *Bacillus subtilis*, boscalid, pyraclostrobin, pyrimethanil and trifloxystrobin in some fruit crops

Appendices

Appendix I. Example of Methodology Used in the Estimation of Pesticide Use at the Provincial and County Levels

For All Crops in the Survey

The expansion factor for each crop is the ratio of the total area of each crop to the area of that crop (sprayed or not) reported in the survey.

Example: Calculation of expansion factor for soybeans

Total area of soybeans in 2008	2,100,000 acres
Total area of soybeans reported in survey	94,780 acres
Therefore, the expansion factor for soybeans is:	2,100,000 / 94,780 = 22.16

For each record in the sample, the quantity of active ingredient of all chemicals was computed by multiplying area sprayed times concentration times application rate. The sample total for each pesticide used was then multiplied by the expansion factor for the corresponding treated crop to arrive at an estimate of the total quantity of active ingredient for a particular pesticide used.

Example: Estimation of s-metolachlor used on soybeans in the province

Total quantity of active ingredient of s-metolachlor used on soybeans in the sample was 3,734.64 kg.

Therefore, the total quantity of active ingredient of s-metolachlor used on soybeans would be:

$$3{,}734.64 \times 22.16 = 82{,}760 \text{ kg}$$

(This is the figure that appears in Appendix II.)

Once the provincial level estimate of pesticide usage was determined, the total was allocated to counties on the basis of area grown.

Example: Estimation of s-metolachlor used on soybeans in Lambton County

The area grown to soybeans in Lambton County (243,000 acres in 2008) accounted for 11.6% of the provincial total.

Therefore, the total quantity of active ingredient of s-metolachlor used on soybeans in Lambton County would be:

$$0.116 \times 82{,}760 = 9{,}600 \text{ kg}$$

(This represents the share that s-metolachlor use on soybeans contributes to the Lambton County estimate for "other herbicides" which appears in Appendix VIII.)

Appendix II. Quantities of Specific Pesticide Active Ingredients Used on Field Crops in Ontario, 2008

Pesticide by Crop	Quantity
Herbicides	**kg**
field corn	
2,4-D amines	1,555
2,4-D ester	564
amitrole	525
atrazine	448,071
bentazon	2,971
bromoxynil	3,477
dicamba	74,869
diflufenzopyr	3,618
dimethenamid	51,658
flufenacet	748
foramsulfuron	1,474
glufosinate ammonium	13,561
glyphosate	527,952
isoxaflutole	8,082
linuron	977
mesotrione	23,490
nicosulfuron	674
pendimethalin	42,400
rimsulfuron	622
s-metolachlor	356,748
other	325
Total	**1,564,362**
soybeans	
2,4-D amines	1,002
aciflurofen	763
bentazon	30,680
chlorimuron ethyl	414
cloransulam-methyl	232
dimethenamid	9,086
fluazifop-p-butyl	455
flufenacet	1,181
flumetsulam	1,364
fomesafen	2,283
glyphosate	1,253,773
imazethapyr	8,470
linuron	1,169
metribuzin	42,194
pendimethalin	3,501
quizalofop-p-ethyl	1,325
sethoxydim	407
s-metolachlor	82,760
trifluralin	4,267
other	619
Total	**1,445,945**
canola	
2,4-D amines (post-harvest)	1,838
clopyralid	943
diquat	1,110
glufosinate ammonium	1,480
glyphosate	11,087
sethoxydim	1,071
other	191
Total	**17,719**
tobacco	
napropamide	1,212
Total	**1,212**

Pesticide by Crop	Quantity
Herbicides (continued)	**kg**
wheat	
2,4-D amines	30,911
2,4-D ester	29,460
2,4-DB (butyl ester)	3,189
amitrole	1,121
bromoxynil	62,272
dicamba	1,625
dichlorprop	29,265
fenoxaprop-p-ethyl	274
glyphosate	155,428
MCPA/MCPB	80,474
mecoprop-p	1,066
pyrasulfotole	234
tralkoxydim	255
other	328
Total	**395,901**
oats	
2,4-D amines	2,818
2,4-DB (butyl ester)	3,147
bromoxynil	543
dicamba	901
glyphosate	9,206
MCPA/MCPB	4,688
mecoprop-p	861
other	12
Total	**22,175**
barley	
2,4-D amines	4,024
2,4-D ester	370
2,4-DB (butyl ester)	10,910
bromoxynil	7,450
dichlorprop	394
glyphosate	6,588
MCPA/MCPB	13,885
tralkoxydim	419
other	183
Total	**44,223**
mixed grains	
2,4-D amines	2,687
2,4-D ester	560
2,4-DB (butyl ester)	8,899
bromoxynil	1,065
glyphosate	6,167
MCPA/MCPB	6,316
other	28
Total	**25,722**
rye	
2,4-D amines	4,706
bromoxynil	926
glyphosate	3,185
MCPA/MCPB	870
other	12
Total	**9,699**

Pesticide by Crop	Quantity
Herbicides (continued)	**kg**
white beans	
bentazon	4,204
dimethenamid	2,301
fomesafen	1,966
glufosinate ammonium	317
glyphosate	18,054
imazethapyr	763
pendimethalin	2,020
s-metolachlor	6,119
trifluralin	4,764
other	440
Total	**40,949**
other dry beans	
bentazon	3,222
dimethenamid	9,874
diquat	1,069
fomesafen	866
glyphosate	18,661
imazethapyr	937
metribuzin	345
pendimethalin	5,690
s-metolachlor	642
trifluralin	5,714
other	139
Total	**47,159**
hay	
2,4-D amines	933
2,4-D ester	1,999
2,4-DB (butyl ester)	3,934
glyphosate	27,011
other	265
Total	**34,143**
pasture	
2,4-DB (butyl ester)	356
dicamba	823
glyphosate	2,717
other	214
Total	**4,110**
sugar beets	
desmedipham	309
ethofumesate	1,069
glyphosate	1,386
phenmedipham	309
other	41
Total	**3,116**
other field crops	
atrazine	720
fluazifop-p-butyl	281
glyphosate	1,991
other	19
Total	**3,011**
Total Herbicides	**3,659,447**

Appendix II. Quantities of Specific Pesticide Active Ingredients Used on Field Crops in Ontario, 2008

Pesticide by Crop	Quantity
Insecticides	**kg**
wheat	
carbaryl	853
cyhalothrin-lambda	604
methomyl	1,426
other	174
Total	**3,057**
rye	
carbaryl	3,315
other	38
Total	**3,353**
field corn	
carbaryl	665
tefluthrin	462
other	24
Total	**1,151**
canola	
carbaryl	210
other	15
Total	**225**
white beans	
dimethoate	1,210
Total	**1,210**
other dry beans	
dimethoate	287
Total	**287**
tobacco	
acephate	1,645
other	36
Total	**1,681**
other field crops	**5**
Total Insecticides	**10,969**

Pesticide by Crop	Quantity
Fungicides	**kg**
wheat	
azoxystrobin	540
propiconazole	6,781
prothioconazole	2,367
pyraclostrobin	2,584
tebuconazole	13,329
trifloxystrobin	1,969
Total	**27,569**
barley	
propiconazole	495
other	184
Total	**680**
soybeans	
pyraclostrobin	320
other	66
Total	**386**
field corn	
pyraclostrobin	479
other	29
Total	**508**
canola	
boscalid	245
prothioconazole	438
Total	**682**
white beans	
boscalid	1,354
pyraclostrobin	259
Total	**1,613**
other dry beans	
boscalid	3,949
pyraclostrobin	659
vinclozolin	449
Total	**5,057**
sugar beets	
propiconazole	281
pyraclostrobin	386
thiophanate-methyl	786
Total	**1,452**
other field crops	**219**
Total Fungicides	**38,166**

Pesticide by Crop	Quantity
Nematocides	**kg**
tobacco	
1,3 dichloropropene	158,791
chloropicrin	32,426
metam-sodium	15,265
Total	**206,483**
Total Nematocides	**206,483**
Growth Regulators	
wheat	
ethephon	401
Total	**401**
tobacco	
fatty alcohol - N-decanol	19,809
Total	**19,809**
Total Growth Regulators	**20,211**
Total All Pesticides Used on Field Crops	**3,935,275**

Appendix III. Quantities of Specific Pesticide Active Ingredients Used on All Fruit in Ontario, 2008

Pesticide Used	Quantity kilograms
HERBICIDES	
2,4-D amines	593
diuron	1,451
glufosinate ammonium	245
glyphosate	6,700
linuron	795
napropamide	742
paraquat	352
simazine	1,147
terbacil	314
other	789
Total	**13,130**
INSECTICIDES	
acequinocyl	220
acetamiprid	293
azinphos-methyl	1,520
Bacillus thuringiensis	237
carbaryl	4,597
carbofuran	263
chlorpyrifos	4,053
diazinon	2,966
endosulfan	2,622
kaolin	11,293
malathion	923
permethrin	644
phosalone	2,419
phosmet	25,724
spirodiclofen	573
thiacloprid	837
other	1,547
Total	**60,732**
NEMATOCIDES	
Total	**74**

Pesticide Used	Quantity kilograms
FUNGICIDES	
Bacillus subtilis	396
boscalid	1,665
captan	117,189
chlorothalonil	10,463
copper oxychloride	5,283
copper sulfate	2,714
cyprodinil	969
dinocap	1,555
dodine	219
fenbuconazole	359
fenhexamid	1,498
ferbam	3,295
folpet	2,366
fosetyl-al	2,048
iprodione	713
kresoxim-methyl	802
lime sulphur - calcium polysulphide	441
mancozeb	84,976
metiram	69,437
myclobutanil	612
potassium bicarbonate	3,098
propiconazole	277
pyraclostrobin	298
pyrimethanil	2,221
streptomycin	332
sulphur	144,427
trifloxystrobin	475
other	128
Total	**458,257**
GROWTH REGULATORS	
prohexadione calcium	395
other	206
Total	**601**
GRAND TOTAL	**532,794**

Appendix IV. Quantities of Specific Pesticide Active Ingredients Used on All Vegetables in Ontario, 2008

Pesticide Used	Quantity kilograms
INSECTICIDES	
acephate	343
carbaryl	1,861
carbofuran	391
chlorantraniliprole	239
chlorpyrifos	5,234
cyhalothrin-lambda	404
cypermethrin	1,887
diazinon	4,996
dimethoate	896
endosulfan	2,290
formetanate hydrochloride	336
imidacloprid	1,641
malathion	389
methamidophos	2,814
methomyl	203
phosmet	1,944
other	168
Total	**26,036**
FUNGICIDES	
azoxystrobin	738
boscalid	370
chlorothalonil	92,706
copper hydroxide	19,390
copper oxychloride	1,265
fenamidone	2,262
fosetyl-al	1,014
iprodione	696
mancozeb	49,093
metiram	18,253
propamocarb hydrochloride	1,237
pyraclostrobin	267
other	143
Total	**187,433**

Pesticide Used	Quantity kilograms
HERBICIDES	
atrazine	11,424
bentazon	3,312
bromoxynil	1,076
dimethenamid	965
diquat	1,922
diuron	435
fluazifop-p-butyl	216
glyphosate	6,110
imazethapyr	406
linuron	13,464
MCPA/MCPB	1,038
mesotrione	407
metribuzin	3,935
oxyfluorfen	500
paraquat	1,536
pendimethalin	2,892
prometryne	2,100
s-metolachlor	25,323
trifluralin	2,979
other	589
Total	**80,629**
GROWTH REGULATORS	
ethephon	2,278
maleic hydrazide	1,259
Total	**3,538**
NEMATOCIDES	
metam-sodium	39,993
Total	**39,993**
GRAND TOTAL	**337,629**

Appendix V. Quantities of Specific Pesticide Active Ingredients Used on Other Agricultural Crops[a] in Ontario, 2008

Pesticide Used	Quantity kilograms	Pesticide Used	Quantity kilograms
HERBICIDES		**FUNGICIDES**	
2,4-D amines	8,738	azoxystrobin	600
dicamba	707	captan	816
glyphosate	6,635	chlorothalonil	8,697
mecoprop-p	4,305	copper oxychloride	936
simazine	1,059	fosetyl-al	6,380
s-metolachlor	606	iprodione	382
other	255	mancozeb	10,354
Total	**22,305**	metiram	706
		myclobutanil	434
INSECTICIDES		propiconazole	619
acephate	2,929	other	184
carbaryl	3,878	**Total**	**30,108**
dicofol	332		
endosulfan	233		
imidacloprid	214		
malathion	346		
other	252		
Total	**8,185**	**GRAND TOTAL**	**60,598**

[a] Other crops include nursery crops, sod and ginseng. Greenhouse crops are not included in the survey.

Appendix VI. Quantities of Active Ingredients of Each Type of Pesticide Used on All Surveyed Crops in Ontario, 2008

Crop	Herbicides				Insecticides	Fungicides	Nematocides	Growth Regulators	Total Pesticides	Percentage of Usage by Crop
	Triazine	Auxinic[b]	Sulfonylurea	Other						
	- tonnes -									%
Field Corn	448.1	77.1	2.9	1,036.3	1.2	0.5	-	-	**1,566.0**	32.2
Soybeans	42.2	1.0	0.6	1,402.2	-	0.4	-	-	**1,446.3**	29.7
Dry Beans	0.3	0.1	-	87.7	1.5	6.7	-	-	**96.3**	2.0
Tobacco	-	-	-	1.2	1.7	-	206.5	19.8	**229.2**	4.7
Grains[a]	-	242.1	0.2	255.4	6.4	28.5	-	0.4	**533.0**	11.0
Hay and Pasture	-	8.5	-	29.7	-	-	-	-	**38.3**	0.8
Other Field Crops	0.7	2.8	-	20.3	0.2	2.1	-	-	**26.2**	0.5
Field Crops	**491.3**	**331.6**	**3.7**	**2,832.7**	**11.0**	**38.2**	**206.5**	**20.2**	**3,935.3**	**80.9**
Fruit	1.2	0.8	-	11.1	60.7	458.3	0.1	0.6	**532.8**	10.9
Vegetables	17.5	1.2	0.1	61.9	26.0	187.4	40.0	3.5	**337.6**	6.9
Other Crops	1.1	13.9	-	7.3	8.2	30.1	-	-	**60.6**	1.2
All Surveyed Crops	**511.1**	**347.6**	**3.8**	**2,913.0**	**105.9**	**714.0**	**246.5**	**24.3**	**4,866.3**	**100.0**
% of Usage by Pesticide Grouping	10.5	7.1	0.1	59.9	2.2	14.7	5.1	0.5	**100.0**	

[a] Includes wheat, oats, barley, mixed grain and rye.

[b] Includes phenoxy herbicides.

Note: Totals may not add due to rounding.

Appendix VII. Quantities of Specific Pesticide Active Ingredients Used on All Surveyed Crops in Ontario, 2008

Pesticide Used	Quantity
Triazine Herbicides	**kg**
atrazine	460,215
metribuzin	46,572
prometryne	2,100
simazine	2,206
Total	**511,093**
Auxinic Herbicides [a]	
2,4-D amines	60,076
2,4-D ester	33,166
2,4-DB (butyl ester)	30,546
clopyralid	976
dicamba	78,957
dichlorprop	29,878
MCPA/MCPB	107,663
mecoprop-p	6,232
other	82
Total	**347,576**
Sulfonylurea Herbicides	
chlorimuron ethyl	414
foramsulfuron	1,474
nicosulfuron	674
rimsulfuron	682
thifensulfuron-methyl	378
other	179
Total	**3,801**
Other Herbicides	
aciflurofen	763
amitrole	1,707
bentazon	44,389
bromoxynil	76,978
cloransulam-methyl	232
desmedipham	329
diflufenzopyr	3,618
dimethenamid	73,985
diquat	4,223
diuron	1,886
ethofumesate	1,069
fenoxaprop-p-ethyl	509
fluazifop-p-butyl	1,064
flufenacet	1,930
flumetsulam	1,364
fomesafen	5,116
glufosinate ammonium	15,683
glyphosate	2,062,648
imazethapyr	10,593
isoxaflutole	8,082
linuron	16,405
mesotrione	23,897
napropamide	1,957
oxyfluorfen	500
paraquat	1,888
pendimethalin	56,504
phenmedipham	329
pyrasulfotole	251
quizalofop-p-ethyl	1,372
sethoxydim	1,837
s-metolachlor	472,334
terbacil	314
tralkoxydim	674
trifluralin	17,926
other	683
Total	**2,913,041**

Pesticide Used	Quantity
Insecticides	**kg**
acephate	4,917
acequinocyl	255
acetamiprid	295
azinphos-methyl	1,523
Bacillus thuringiensis	279
carbaryl	15,379
carbofuran	654
chlorantraniliprole	432
chlorpyrifos	9,287
cyhalothrin-lambda	1,131
cypermethrin	2,038
diazinon	7,979
dicofol	388
dimethoate	2,736
endosulfan	5,146
formetanate hydrochloride	336
imidacloprid	1,945
kaolin	11,293
malathion	1,658
methamidophos	2,814
methomyl	1,629
permethrin	670
phosalone	2,419
phosmet	27,842
spirodiclofen	573
tefluthrin	462
thiacloprid	837
other	1,002
Total	**105,922**
Nematocides	
1,3 dichloropropene	158,791
chloropicrin	32,426
metam-sodium	55,258
other	74
Total	**246,550**
Growth Regulators	
ethephon	2,795
fatty alcohol - N-decanol	19,809
maleic hydrazide	1,259
prohexadione calcium	395
other	91
Total	**24,350**

Pesticide Used	Quantity
Fungicides	**kg**
azoxystrobin	1,910
Bacillus subtilis	405
boscalid	7,643
captan	118,005
chlorothalonil	111,866
copper hydroxide	19,390
copper oxychloride	7,484
copper sulfate	2,853
cyprodinil	969
dinocap	1,555
dodine	219
fenamidone	2,262
fenbuconazole	359
fenhexamid	1,498
ferbam	3,295
folpet	2,366
fosetyl-al	9,443
iprodione	1,791
kresoxim-methyl	802
lime sulphur - calcium polysulphide	441
mancozeb	144,423
metiram	88,396
myclobutanil	1,073
potassium bicarbonate	3,098
propamocarb hydrochloride	1,237
propiconazole	8,666
prothioconazole	2,837
pyraclostrobin	5,289
pyrimethanil	2,221
streptomycin	332
sulphur	144,427
tebuconazole	13,425
thiophanate-methyl	925
trifloxystrobin	2,444
vinclozolin	449
other	165
Total	**713,964**
Total All Pesticides	**4,866,296**

a Includes phenoxy herbicides.

Appendix VIII. Quantities of Active Ingredients of Each Type of Pesticide Used on All Surveyed Crops in 2008, By Region and County, Ontario

	Herbicides	Insecticides	Fungicides	Nematocides & Growth Regulators	Total Pesticides
			- tonnes -		
Brant	60.8	2.2	17.5	35.0	115.6
Chatham-Kent	272.7	5.3	64.0	4.5	346.4
Elgin	159.0	5.4	21.2	25.7	211.3
Essex	200.7	5.6	55.3	40.8	302.4
Haldimand-Norfolk	184.8	12.6	58.5	135.5	391.5
Hamilton	59.4	4.6	22.2	-	86.2
Lambton	291.7	2.8	15.0	0.6	310.1
Middlesex	273.4	3.4	13.0	9.4	299.2
Niagara	80.1	16.9	241.1	0.2	338.3
Oxford	206.2	2.7	11.6	18.1	238.6
Southern Ontario	**1,788.7**	**61.6**	**519.3**	**269.9**	**2,639.5**
Bruce	145.0	0.6	3.0	-	148.7
Dufferin	29.9	1.5	10.9	-	42.3
Grey	53.9	9.0	34.6	-	97.7
Halton	31.7	1.7	6.9	-	40.3
Huron	270.7	2.3	5.9	-	278.9
Peel	29.0	0.9	3.7	-	33.6
Perth	204.9	0.7	3.7	-	209.3
Simcoe	142.8	8.3	40.4	0.4	191.9
Waterloo	70.3	0.9	3.7	-	74.9
Wellington	174.2	0.9	4.3	-	179.4
Western Ontario	**1,152.5**	**26.8**	**117.1**	**0.6**	**1,297.0**
Durham	103.5	4.0	13.1	-	120.6
Hastings	20.2	0.6	2.9	-	23.6
Kawartha Lakes	54.1	0.3	1.1	-	55.5
Northumberland	64.9	2.4	9.2	-	76.6
Peterborough	24.7	-	0.8	-	25.6
Prince Edward	28.1	0.7	6.4	-	35.2
York	62.4	4.5	23.8	0.3	91.0
Other	0.7	-	0.2	-	1.0
Central Ontario	**358.5**	**12.7**	**57.4**	**0.4**	**429.0**
Frontenac	8.1	-	0.7	-	8.9
Lanark	15.6	0.2	0.9	-	16.8
Leeds and Grenville	33.6	0.6	2.3	-	36.6
Lennox and Addington	15.3	-	0.6	-	16.1
Ottawa	81.7	0.9	2.8	-	85.5
Prescott and Russell	107.6	0.5	2.1	-	110.3
Renfrew	33.9	0.5	2.0	-	36.4
Stormont, Dundas and Glengarry	147.9	0.9	3.7	-	152.5
Eastern Ontario	**443.9**	**3.9**	**15.2**	**-**	**463.0**
Northern Ontario	**31.9**	**0.9**	**4.9**	**-**	**37.7**
Ontario	**3,775.5**	**105.9**	**714.0**	**270.9**	**4,866.3**

- less than 200 kg

Note: Totals may not add due to rounding.

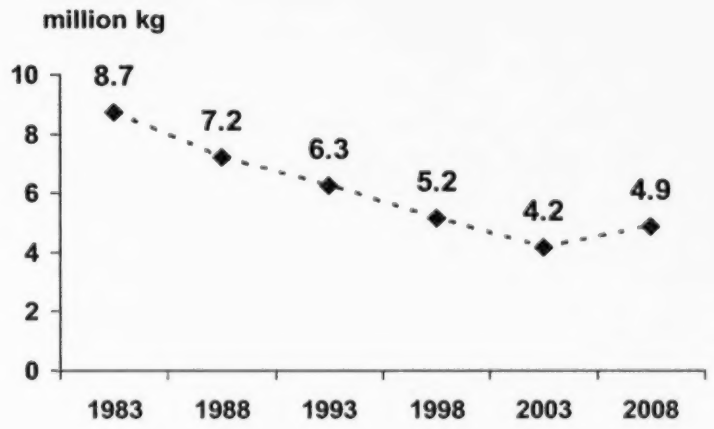
Appendix IX. Comparison of Total Active Ingredients Used on Major Crops and for Selected Pesticide Groupings, 1983, 1988, 1993, 1998, 2003 and 2008

Crop	Pesticide or Group	Active Ingredient Used					
		1983	1988	1993	1998	2003	2008
		- kilograms -					
field corn	alachlor	614,680	940	-	-	-	-
	atrazine	1,719,840	999,410	585,208	573,721	499,253	448,071
	glyphosate	4,140	17,210	71,862	70,924	125,016	527,952
	metolachlor/s-metolachlor	491,020	712,170	897,870	773,833	313,934	356,748
	all herbicides	3,653,310	2,491,370	2,351,146	1,982,949	1,525,659	1,564,362
soybeans	alachlor	436,800	1,190	-	-	-	-
	metolachlor/s-metolachlor	325,450	915,170	391,152	552,963	190,301	82,760
	glyphosate	28,450	41,770	164,784	375,109	861,983	1,253,773
	all herbicides	1,281,880	1,694,770	1,133,103	1,274,624	1,196,055	1,445,945
grains	all herbicides	376,140	491,320	443,620	356,641	407,125	497,721
total field crops	all herbicides	5,411,260	4,984,560	4,143,523	3,763,481	3,225,735	3,659,447
	all pesticides	7,800,480	6,206,580	5,211,758	4,293,051	3,729,341	3,935,275
total fruit	all fungicides	410,990	429,610	457,509	459,197	209,592	458,257
	all pesticides	562,640	598,560	628,111	543,061	248,732	532,794
total vegetables	all pesticides	356,120	396,330	406,573	331,363	204,416	337,629
total field crops, fruit & vegetables	all pesticides	8,719,240	7,201,470	6,246,442	5,167,475	4,182,489	4,805,698

Appendix X. Comparison of Total Active Ingredients Used per Hectare on Major Crops and for Selected Pesticide Groupings, 1983, 1988, 1993, 1998, 2003 and 2008

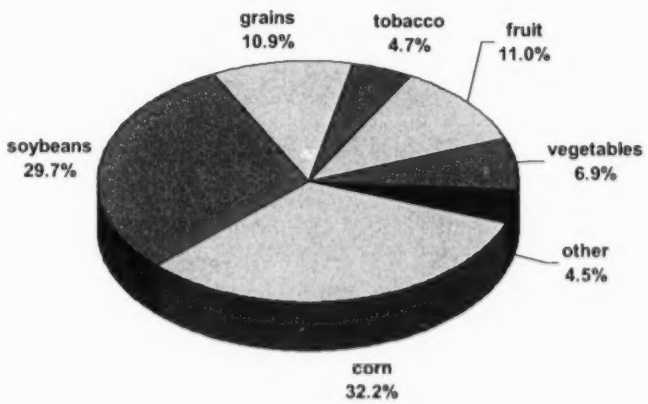
Crop	Pesticide or Group	Active Ingredient Used per Area Grown					
		1983	1988	1993	1998	2003	2008
		- kg/ha -					
field corn	all herbicides	3.47	2.90	2.90	2.28	1.77	1.90
soybeans	all herbicides	3.52	3.27	1.65	1.50	1.48	1.70
grains	all herbicides	0.44	0.58	0.72	0.56	0.58	0.69
total field crops	all herbicides	1.33	1.31	1.13	1.01	0.86	0.96
	all pesticides	1.92	1.63	1.42	1.15	1.00	1.03
total fruit	all fungicides	14.47	14.81	15.10	17.20	8.32	20.83
	all pesticides	19.81	20.64	20.73	20.34	9.87	24.22
total vegetables	all pesticides	4.89	6.01	5.91	4.72	2.65	5.40
total field crops, fruit & vegetables	all pesticides	2.10	1.85	1.66	1.35	1.09	1.23

Pesticide active ingredients used on all crops in Ontario, 1983 to 2008



Pesticide active ingredients used in Ontario, by crop, 2008

(total = 4.87 million kg)



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